



Immune System

Whether you're stomping through the showers in your bare feet after gym class or touching the bathroom doorknob, you're being exposed to germs. Fortunately for most of us, the immune system is constantly on call to do battle with bugs that could put us out of commission.

What the Immune System Does

The immune (pronounced: ih-MYOOON) system, which is made up of special cells, proteins, tissues, and organs, defends people against germs and microorganisms every day. In most cases, the immune system does a great job of keeping people healthy and preventing infections. But sometimes, problems with the immune system can lead to illness and infection.

The immune system is the body's defense against infectious organisms and other invaders. Through a series of steps called the **immune response**, the immune system attacks organisms and substances that invade our systems and cause disease. The immune system is made up of a network of cells, tissues, and organs that work together to protect the body.

About Cells

The cells that are part of this defense system include white blood cells, also called **leukocytes** (pronounced: LOO-kuh-sytes). They come in two basic types (more on these below), which combine to seek out and destroy the organisms or substances that cause disease.

Leukocytes are produced and stored in many locations throughout the body, including the thymus, spleen, and bone marrow. For this reason, they are called the **lymphoid** (pronounced: LIM-foyd) organs. There are also clumps of lymphoid tissue throughout the body, primarily in the form of lymph nodes, that house the leukocytes.

The leukocytes circulate through the body between the organs and nodes by means of the **lymphatic** (pronounced: lim-FAT-ik) **vessels**. (You can think of the lymphatic vessels as a type of highway between the rest stops that are the lymphoid organs and lymph nodes.) Leukocytes can also circulate through the blood vessels. In this way, the immune system works in a coordinated manner to monitor the body for germs or substances that might cause problems.

There are two basic types of leukocytes:

1. The **phagocytes** (pronounced: FAH-guh-sytes) are cells that chew up invading organisms.
2. The **lymphocytes** (pronounced: LIM-fuh-sytes) are cells that allow the body to remember and recognize previous invaders and help the body destroy them.

A number of different cells are considered phagocytes. The most common type is the **neutrophil** (pronounced: NOO-truh-fil), which primarily fights bacteria. So when doctors are worried about a bacterial infection, sometimes they order a blood test to see if a patient has an increased number of neutrophils triggered by the infection. Other types of phagocytes have their own jobs to make sure that the body responds appropriately to a specific type of invader.

There are two kinds of lymphocytes: the **B lymphocytes** and the **T lymphocytes**. Lymphocytes start out in the bone marrow and either stay and mature there to become B cells or leave for the thymus gland, where they mature to become T cells.

B lymphocytes and T lymphocytes have separate jobs to do: B lymphocytes are like the body's military intelligence system, seeking out their targets and sending defenses to lock onto them. T cells are like the soldiers, destroying the invaders that the intelligence system has identified. Here's how it works.

A foreign substance that invades the body is called an **antigen** (pronounced: AN-tih-jun). When an antigen is detected, several types of cells work together to recognize and respond to it. These cells trigger the B lymphocytes to produce **antibodies** (pronounced: AN-tye-bah-deez). Antibodies are specialized proteins that lock onto specific antigens. Antibodies and antigens fit together like a key and a lock.

Once the B lymphocytes recognize specific antigens, they develop a memory for the antigen and will produce antibodies the next time the antigen enters a person's body. That's why if someone gets sick with a certain disease, like chickenpox, that person typically doesn't get sick from it again.

This is also why we use immunizations to prevent certain diseases. The immunization introduces the body to the antigen in a way that doesn't make a person sick, but it does allow the body to produce antibodies that will then protect that person from future attack by the germ or substance that produces that particular disease.

Although antibodies can recognize an antigen and lock onto it, they are not capable of destroying it without help. That is the job of the T cells. The T cells are part of the system that destroys antigens that have been tagged by antibodies or cells that have been infected or somehow changed. (There are actually T cells that are called "killer cells.") T cells are also involved in helping signal other cells (like phagocytes) to do their jobs.

Antibodies can also neutralize toxins (poisonous or damaging substances) produced by different organisms. Lastly, antibodies can activate a group of proteins called **complement** that are also part of the immune system. Complement assists in killing bacteria, viruses, or infected cells.

All of these specialized cells and parts of the immune system offer the body protection against disease. This protection is called immunity.

Immunity

Humans have three types of immunity — innate, adaptive, and passive:

Innate Immunity

Everyone is born with innate (or natural) immunity, a type of general protection that humans have. Many of the germs that affect other species don't harm us. For example, the viruses that cause leukemia in cats or distemper in dogs don't affect humans. Innate immunity works both ways because some viruses that make humans ill — such as the virus that causes HIV/AIDS — don't make cats or dogs sick either.

Innate immunity also includes the external barriers of the body, like the skin and mucous membranes (like those that line the nose, throat, and gastrointestinal tract), which are our first line of defense in preventing diseases from entering the body. If this outer defensive wall is broken (like if you get a cut), the skin attempts to heal the break quickly and special immune cells on the skin attack invading germs.

Adaptive Immunity

We also have a second kind of protection called adaptive (or active) immunity. This type of immunity develops throughout our lives. Adaptive immunity involves the lymphocytes (as in the process described above) and develops as children and adults are exposed to diseases or immunized against diseases through vaccination.

Passive Immunity

Passive immunity is "borrowed" from another source and it lasts for a short time. For example, antibodies in a mother's breast milk provide an infant with temporary immunity to diseases that the mother has been exposed to. This can help protect the infant against infection during the early years of childhood.

Everyone's immune system is different. Some people never seem to get infections, whereas others seem to be sick all the time. As people get older, they usually become immune to more germs as the immune system comes into contact with more and more of them. That's why adults and teens tend to get fewer colds than kids — their bodies have learned to recognize and immediately attack many of the viruses that cause colds.

Things That Can Go Wrong With the Immune System

Disorders of the immune system can be broken down into four main categories:

1. immunodeficiency disorders (primary or acquired)
2. autoimmune disorders (in which the body's own immune system attacks its own tissue as foreign matter)
3. allergic disorders (in which the immune system overreacts in response to an antigen)
4. cancers of the immune system

Immunodeficiency Disorders

Immunodeficiencies (pronounced: ih-myoon-o-dih-FIH-shun-seez) happen when a part of the immune system is not present or is not working properly.

Sometimes a person is born with an immunodeficiency — these are called primary immunodeficiencies. (Although primary immunodeficiencies are conditions that a person is born with, symptoms of the disorder sometimes may not show up until later in life.)

Immunodeficiencies also can be acquired through infection or produced by drugs. These are sometimes called secondary immunodeficiencies.

Immunodeficiencies can affect B lymphocytes, T lymphocytes, or phagocytes. The most common immunodeficiency disorder is **IgA deficiency**, in which the body doesn't produce enough of the antibody IgA, an immunoglobulin found

primarily in the saliva and other body fluids that help guard the entrances to the body. People with IgA deficiency tend to have allergies or get more colds and other respiratory infections, but the condition is usually not severe.

Acquired (or secondary) immunodeficiencies usually develop after a person has a disease, although they can also be the result of malnutrition, burns, or other medical problems. Certain medicines also can cause problems with the functioning of the immune system.

Acquired (secondary) immunodeficiencies include:

- **HIV (human immunodeficiency virus) infection and AIDS (acquired immunodeficiency syndrome).** This disease slowly and steadily destroys the immune system. It is caused by HIV, a virus which wipes out certain types of lymphocytes called T-helper cells. Without T-helper cells, the immune system is unable to defend the body against normally harmless organisms, which can cause life-threatening infections in people who have AIDS.

Newborns can get HIV infection from their mothers while in the uterus, during the birth process, or during breastfeeding. Teens and adults can get HIV infection by having unprotected sexual intercourse with an infected person or from sharing contaminated needles for drugs, steroids, or tattoos.

- **Immunodeficiencies caused by medications.** Some medicines suppress the immune system. One of the drawbacks of chemotherapy treatment for cancer, for example, is that it not only attacks cancer cells, but other fast-growing, healthy cells, including those found in the bone marrow and other parts of the immune system.

In addition, people with autoimmune disorders or who have had organ transplants may need to take immunosuppressant medications. These medicines can also reduce the immune system's ability to fight infections and can cause secondary immunodeficiency.

Autoimmune Disorders

In autoimmune disorders, the immune system mistakenly attacks the body's healthy organs and tissues as though they were foreign invaders.

Some autoimmune diseases include:

- **Lupus** is a chronic disease marked by muscle and joint pain and inflammation. The abnormal immune response may also involve attacks on the kidneys and other organs.
- **Juvenile idiopathic arthritis** is a disease in which the body's immune system acts as though certain body parts such as the joints of the knee, hand, and foot are foreign tissue and attacks them.
- **Scleroderma** is a chronic autoimmune disease that can lead to inflammation and damage of the skin, joints, and internal organs.
- **Ankylosing spondylitis** is a disease that involves inflammation of the spine and joints, causing stiffness and pain.
- **Juvenile dermatomyositis** is a disorder marked by inflammation and damage of the skin and muscles.

Allergic Disorders

Allergic disorders happen when the immune system overreacts when exposed to antigens in the environment. The substances that provoke such attacks are called allergens. The immune response can cause symptoms such as swelling, watery eyes, and sneezing, and even a life-threatening reaction called anaphylaxis. Taking medications called antihistamines can relieve most symptoms.

Allergic disorders include:

- **Asthma**, a respiratory disorder that can cause breathing problems, frequently involves an allergic response by the lungs. If the lungs are oversensitive to certain allergens (like pollen, molds, animal dander, or dust mites), it can trigger breathing tubes in the lungs to become narrowed and swollen, leading to reduced airflow and making it hard for a teen to breathe.
- **Eczema** is an itchy rash also known as atopic dermatitis. Although atopic dermatitis is not necessarily caused by an allergic reaction, it more often happens in kids and teens who have allergies, hay fever, or asthma or who have a family history of these conditions.
- **Allergies** of several types can happen in teens. Environmental allergies (to dust mites, for example), seasonal allergies (such as hay fever), drug allergies (reactions to specific medications or drugs), food allergies (such as to nuts), and allergies to toxins (bee stings, for example) are the common conditions people usually refer to as allergies.

Cancers of the Immune System

Cancer happens when cells grow out of control. This can also happen with the cells of the immune system. Leukemia, which involves abnormal overgrowth of leukocytes, is the most common childhood cancer. Lymphoma involves the lymphoid tissues and is also one of the more common childhood cancers. With current medications most cases of both types of cancer in kids and teens are curable.

Although immune system disorders usually can't be prevented, you can help your immune system stay stronger and fight illnesses by staying informed about your condition and working closely with the doctor.

And if you're lucky enough to be healthy, you can help your immune system keep you that way by washing your hands often to avoid infection, eating right, getting plenty of exercise, and getting regular medical checkups.

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